

PRELIMINARY DATA SUMMARY

July 1991

U.S. Army Engineer Waterways Experiment Station
Coastal Engineering Research Center
Field Research Facility
Duck, North Carolina

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CERC Field Research Facility
Duck, North Carolina

This report provides a summary of basic oceanographic, meteorological and bottom profile data for the month. The data were obtained as part of the Measurements and Analysis work units at the U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center's Field Research Facility (FRF) in Duck, North Carolina. The FRF staff collected and analyzed these data. These summaries are intended to make the data readily available to all FRF users, and comments on their content and usefulness are invited.

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PART I: INTRODUCTION

The U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center's (CERC's) Field Research Facility (FRF) is located on the Outer Banks of North Carolina, near the village of Duck (Figure 1).

The FRF research program provides a means for obtaining high-quality field data, particularly during storms, in support of the U.S. Army Corps of Engineers' coastal engineering research missions. The research pier is a reinforced concrete structure supported on 0.9-m-diam steel piles spaced 12.2 m apart along the pier's length and 4.6 m apart across the width. The pier deck is 6.1 m wide and extends from behind the duneline to about the 6-m water depth contour at a height of 7.6 m above the National Geodetic Vertical Datum (NGVD). In addition, a main building contains offices, an instrument repair shop, and a data acquisition room.

One of the responsibilities of the FRF research program is the collection, analysis and dissemination of data on local oceanographic and meteorological conditions. Bottom profiles along both sides of the pier and periodic bathymetric surveys are also performed.

This summary is intended to provide basic data as soon as possible after they are obtained. Questions and/or comments concerning the data may be directed to Mr. Michael W. Leffler at (919) 261-3511.

Part II presents the meteorological data; Parts III through VI present oceanographic data; Part VII presents nearshore profiles and bathymetry; and Part VIII, if included, documents special events that occurred at the FRF during the month.

Table 1 is a list of instruments used, their operational status during the month, and the data collection status. Figure 2 identifies the location of the instruments. The water depths at the wave gages and current meters vary and may be determined from information contained in Figure 7. Other installation information is contained in Table 1.

Times given in the report, unless otherwise specified, are referenced to eastern standard time (EST).

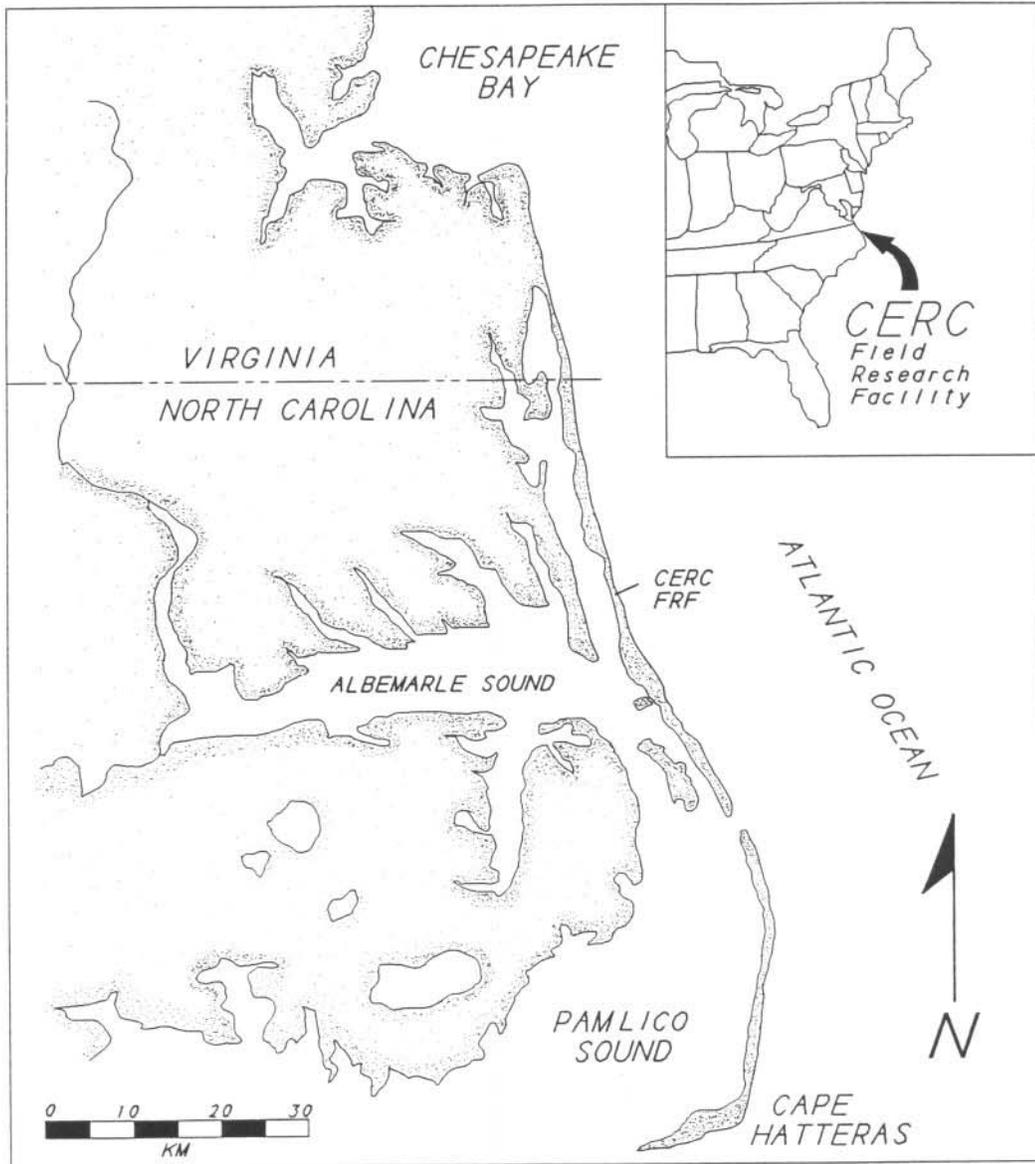


Figure 1. FRF Location Map

Table 1: Instrument Status/Data Availability

JUL 1991

Gage ID	Description/Remarks	Depth at Sensor		Day of the month																														
				1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	2	2	2	2	2	2	3	3	
616	Barometric Pressure		Gage Status	*****																														
			Data Collected	//****//*****																														
			Analog Record	*****																														
604	Precipitation		Gage Status	*****																														
			Data Collected	//****//*****																														
624	Air Temperature		Gage Status	*****																														
			Data Collected	//****//*****																														
932	Anemometer at seaward end of pier Elevation 19 m (NGVD)		Gage Status	*****																														
			Data Collected	//****//*****																														
645	Baylor staff at station 7+80 on FRF pier	see Figure 7	Gage Status	*****																														
			Data Collected	//****//*****																														
625	Baylor staff at station 18+60 on FRF pier	see Figure 7	Gage Status	*****																														
			Data Collected	//****//*****																														
111	Pressure gage 309 m north of FRF pier (0.9 km offshore)	Approx. 7.8 m NGVD	Gage Status	*****																														
			Data Collected	//****//*****																														
630	Waverider buoy 6.0 km offshore	Approx. 23 m NGVD	Gage Status	*****																														
			Data Collected	//****//*****																														
519	Current meter 320 m north of FRF pier (0.9 km offshore)	see Figure 7	Gage Status	*****																														
			Data Collected	//****//*****																														
865-1370	NOAA tide station at seaward end of FRF pier		Gage Status	*****																														
			Data Collected	*****																														
Supplemental Observations (daily oceanographic and meteorological observations)			Daily observation	*****																														

Gage Status Daily Observation Analog Record Data Collected
 Operational = * Complete = * Complete = * All = *
 Partial = / Partial = / Partial = / Partial = /
 Non-Operational = - None = - None = - None = -

PART II: METEOROLOGICAL DATA

A variety of instruments have been installed at the FRF (Figure 2) to monitor the meteorological conditions. The data presented in Table 2 are collected and stored on magnetic tape using a Digital Equipment Corporation VAX 11/750. For each instrument identified in Table 1 as having analog outputs, chart records are obtained, a log is maintained and the records are stored for future reference.

Winds were measured at the end of the pier at an elevation of 19 m (Figure 2) using a Weather Measure Skyvane anemometer.

Monthly resultant wind speeds and directions are determined by vector averaging the data. Temperature and atmospheric pressure means are the average of the values presented for the month. Total precipitation is the sum for the month.

The following may be useful for converting the data in Table 2 to other frequently used units of measurement:

1. Millimeters (mm) to inches (in.) -
 $\text{mm} \times .03937 = \text{in.}$
2. Millibars (mb) to inches of mercury (in. Hg) -
 $\text{mb} \times 0.02953 = \text{in. Hg}$
3. Degrees Celsius (C) to degrees Fahrenheit (F) -
 $(\text{C} \times 9/5) + 32 = \text{F}$
4. Meters per second (m/s) to knots (kn) -
 $\text{m/s} \times 1.943 = \text{kn}$

Table 2: Meteorological Data

Jul 1991

Day	Hour	Wind Speed m/sec	Wind Direction deg TN	Temperature deg C	Atm Pressure mb	Precipitation mm
1	100	9	232	29.5	1007.7	0
	700	9	246	29.7	1008.1	0
	1300					0
	1900					0
2	100					0
	700	8	228	29.2	1010.4	0
	1300	7	219	33.8	1008.7	0
	1900	9	199	31.1	1007.7	0
3	100	8	196	29.0	1007.4	0
	700	1	45	29.3	1008.4	0
	1300	3	40	30.6	1008.1	0
	1900	4	126	29.3	1008.4	0
4	100	3	96	28.4	1010.1	0
	700	7	69	27.5	1011.4	0
	1300	5	205	29.9	1011.4	4
	1900	5	195	30.7	1010.4	0
5	100	8	224	29.2	1010.1	0
	700	5	254	28.5	1010.8	0
	1300	4	249	32.3	1010.8	0
	1900	4	217	31.4	1009.8	0
6	100	6	254	28.5	1010.8	0
	700	4	259	28.2	1012.1	0
	1300	2	69	31.6	1012.8	0
	1900	3	126	28.9	1012.1	0
7	100	3	215	29.1	1012.5	0
	700	4	267	30.1	1013.1	0
	1300					0
	1900					0
8	100					0
	700	6	251	31.2	1010.4	0
	1300	3	118	34.3	1009.8	0
	1900	4	225	33.7	1008.1	0
9	100	6	245	31.6	1008.1	0
	700	6	336	29.9	1009.8	0
	1300	5	21	31.0	1010.8	0
	1900	3	91	28.8	1010.4	0
10	100	5	120	28.8	1010.8	0
	700	4	185	30.9	1010.8	0
	1300	6	137	32.0	1011.1	0
	1900	2	174	29.7	1009.8	0
11	100	2	251	27.9	1009.8	0
	700	3	307	27.8	1010.8	3
	1300	2	59	30.9	1010.8	0
	1900	4	62	28.6	1010.4	0
12	100	6	71	28.0	1011.8	0
	700	6	67	28.7	1012.5	0
	1300	4	91	31.6	1013.1	0
	1900	7	132	29.5	1011.8	0
13	100	5	152	28.3	1009.4	0
	700	7	192	29.6	1008.4	0
	1300	8	222	33.9	1006.7	0
	1900	6	210	29.6	1006.7	0
14	100	6	224	29.7	1007.4	0
	700	4	263	30.4	1008.4	0
	1300	5	260	33.5	1009.4	0
	1900	3	59	29.3	1011.1	0
15	100	6	58	28.4	1013.1	0
	700	5	35	28.8	1016.9	0
	1300	5	41	29.8	1018.2	0
	1900	6	65	28.6	1018.6	0
16	100	6	64	28.3	1019.9	0
	700	6	60	28.7	1021.3	0
	1300	7	69	29.7	1021.3	0
	1900	5	80	28.4	1020.3	0

* electronic problems

(Continued)

(Sheet 1 of 2)

Table 2: Meteorological Data

Jul 1991

Day	Hour	Wind Speed m/sec	Wind Direction deg TN	Temperature deg C	Atm Pressure mb	Precipitation mm
17	100	1	106	27.0	1019.2	0
	700	2	54	28.8	1019.2	0
	1300	3	107	31.4	1018.2	0
	1900	6	121	29.5	1016.5	0
18	100	7	233	29.2	1015.9	0
	700	4	264	29.6	1016.9	0
	1300	4	207	32.4	1015.9	0
	1900	6	212	27.0	1014.5	0
19	100	6	232	29.0	1015.5	0
	700	8	231	29.5	1016.5	0
	1300	7	206	32.0	1016.2	0
	1900	7	217	28.8	1015.2	0
20	100	8	223	29.0	1016.9	0
	700	7	232	28.3	1017.2	0
	1300	6	216	33.4	1016.5	0
	1900	8	241	30.0	1016.9	0
21	100	7	220	29.4	1016.2	0
	700	6	220	29.6	1016.5	0
	1300	3	216	34.1	1015.5	0
	1900	7	215	30.4	1014.5	0
22	100	4	248	30.1	1014.5	0
	700	6	247	30.2	1015.2	0
	1300	5	215	34.8	1014.2	0
	1900	6	221	31.9	1012.8	0
23	100	7	237	30.7	1012.1	0
	700	6	258	30.7	1012.1	0
	1300	5	234	35.6	1010.4	0
	1900	8	205	33.0	1008.4	0
24	100	8	220	30.8	1008.4	0
	700	6	228	30.6	1009.8	0
	1300	4	6	32.0	1010.4	0
	1900	1	276	30.6	1010.1	0
25	100	7	223	30.5	1011.1	0
	700	6	218	30.3	1011.8	0
	1300	11	180	33.3	1012.1	0
	1900	5	102	27.4	1013.5	0
26	100	6	193	30.0	1014.5	0
	700	4	211	30.4	1015.5	0
	1300	8	206	30.1	1015.5	0
	1900	7	197	29.2	1015.5	0
27	100	5	211	29.4	1016.2	0
	700	4	169	27.6	1016.9	0
	1300	8	171	29.4	1014.8	3
	1900	2	243	24.2	1016.2	78
28	100	4	338	22.4	1016.2	0
	700	1	149	23.1	1016.2	12
	1300	2	104	28.3	1016.2	0
	1900	2	350	23.9	1015.9	3
29	100	3	122	24.4	1014.8	0
	700	7	214	25.5	1013.5	0
	1300	7	228	28.9	1012.8	0
	1900	3	329	24.1	1013.5	8
30	100	2	336	24.3	1013.8	0
	700	3	119	24.7	1014.2	0
	1300		Hardware Error			0
	1900	1	340	24.8	1013.1	39
31	100	4	214	24.2	1013.1	0
	700	3	210	25.0	1014.5	0
	1300	3	89	27.0	1014.5	0
	1900	4	160	25.4	1014.2	0
		<u>Resultant</u>		<u>Mean</u>	<u>Mean</u>	<u>Total</u>
		3	206	29.4	1012.9	150

* electronic problems

PART III: WAVE DATA

Wave data are collected from two Baylor staff gages (Gages 625 and 645), a pressure wave gage (Gage 111) and a Waverider buoy (Gage 630) as shown in Table 1 and Figure 2. The data are collected, analyzed, and stored on magnetic tape using a Digital Equipment Corporation VAX 11/750 programmed to sample the wave gages every 6 hr (more frequently during storms) beginning at 0100, 0700, 1300, and 1900 EST. The sampling rate is two times per second for four contiguous 34-min records.

Wave height H_{mo} is an energy-based statistic equal to four times the standard deviation of the sea surface elevations. Wave height reported from the pressure gage has been compensated for hydrodynamic attenuation using linear wave theory. Wave period is identified from the computation of a variance (energy) spectrum with 60 deg of freedom calculated from a 34-min record. Peak wave period T_p is defined as the period associated with the maximum energy in the spectrum. When this analysis is complete, the data are written to magnetic tape.

Table 3 presents the wave heights and periods for each wave record obtained at 6 hr intervals during the month. The monthly means and standard deviations from the means shown in Table 3 are average values computed from this data. Figure 3 is a time history of all H_{mo} and T_p values obtained for all gages.

Differences in wave periods between wave gages (Table 3 and Figure 3) may be the result of wave breaking, wave reformation, or the presence of multiple wave trains containing nearly equal energy.

Table 3: Wave Data

Jul 1991

Day	Hour	645		625		111		630	
		Baylor Hmo.m	at 7+80 T.sec	Baylor Hmo.m	at 18+60 T.sec	Pressure Hmo.m	Gage T.sec	Offshr Hmo.m	Wvrdr T.sec
1	0100	0.27	8.53	0.30	8.53	0.33	8.83	0.52	8.83
	0700	0.25	8.00	0.30	8.26	0.31	8.83	0.49	8.83
	1300								
	1900	Hardware Error							
2	0100								
	0700	0.34	5.12	0.38	4.83	0.40	4.92	0.58	4.83
	1300	0.29	9.14	0.33	9.14	0.33	9.48	0.50	9.85
3	0100	0.39	4.83	0.44	9.14	0.45	8.83	0.81	4.27
	0700	0.41	5.82	0.44	9.48	0.43	8.83	0.61	5.95
	1300	0.49	4.83	0.49	9.48	0.52	9.14	0.65	5.45
4	0100	0.48	5.82	0.44	9.14	0.49	8.83	0.64	6.09
	0700	0.43	8.53	0.44	8.00	0.48	8.83	0.57	6.74
	1300	0.45	7.31	0.46	8.00	0.52	7.53	0.63	7.31
5	0100	0.59	3.41	0.72	3.37	0.63	3.51	0.83	7.53
	0700	0.51	7.53	0.52	7.53	0.45	8.53	0.65	7.53
	1300	0.50	5.45	0.51	5.82	0.51	5.33	0.73	5.22
6	0100	0.45	5.45	0.45	7.53	0.51	7.11	0.73	6.24
	0700	0.45	6.40	0.49	6.24	0.50	6.24	0.69	6.74
	1300	0.46	4.83	0.47	16.00	0.49	15.06	0.57	6.24
7	0100	0.41	15.06	0.45	15.06	0.46	15.06	0.63	5.95
	0700	0.34	15.06	0.37	15.06	0.37	15.06	0.55	15.06
	1300	0.37	5.95	0.41	14.22	0.41	6.24	0.49	6.40
8	0100	0.41	5.22	0.41	14.22	0.45	5.45	0.52	6.40
	0700	0.37	6.40	0.44	14.22	0.39	14.22	0.44	6.92
	1300	0.39	9.14	0.49	10.24	0.49	9.85	0.60	9.85
	1900	0.37	9.85	0.49	10.24	0.51	9.85	0.54	9.48
	0100	Hardware Error							
9	0700	0.31	9.48	0.46	8.83	0.43	9.48	0.51	8.00
	1300	0.34	8.83	0.41	8.83	0.44	8.53	0.51	8.83
	1900	0.34	9.14	0.47	8.83	0.47	8.53	0.54	8.53
10	0100	0.32	9.48	0.43	10.24	0.49	10.67	0.56	8.83
	0700	0.39	8.53	0.52	9.14	0.47	9.48	0.62	9.14
	1300	0.46	9.85	0.60	8.53	0.56	9.14	0.67	8.53
11	0100	0.46	4.13	0.51	8.83	0.47	9.48	0.60	4.20
	0700	0.41	8.53	0.49	9.48	0.43	9.14	0.53	9.48
	1300	0.37	9.48	0.44	9.48	0.42	10.67	0.56	8.83
12	0100	0.51	10.67	0.62	10.24	0.51	9.85	0.69	9.14
	0700	0.43	10.24	0.46	10.24	0.41	10.24	0.53	10.24
	1300	0.25	12.80	0.36	9.14	0.37	9.85	0.40	9.48
13	0100	0.28	10.24	0.34	9.14	0.35	9.14	0.39	12.19
	0700	0.28	12.80	0.33	11.13	0.33	12.19	0.44	11.64
	1300	0.41	11.64	0.42	11.13	0.34	10.67	0.56	10.67
14	0100	0.55	3.88	0.69	3.77	0.59	3.82	0.71	3.88
	0700	0.46	10.67	0.52	4.00	0.44	3.77	0.59	10.67
	1300	0.47	10.67	0.50	11.64	0.46	10.24	0.58	10.67
15	0100	0.54	3.66	0.63	10.24	0.49	3.56	0.72	3.05
	0700	0.49	4.74	0.59	11.13	0.53	5.33	0.72	4.92
	1300	0.43	4.83	0.52	5.22	0.50	4.66	0.68	4.74
16	0100	0.46	5.57	0.57	5.45	0.54	5.69	0.76	5.69
	0700	0.41	4.83	0.55	5.02	0.51	5.12	0.60	5.12
	1300	0.25	10.24	0.34	9.85	0.32	11.13	0.41	10.24
17	0100	0.24	9.85	0.30	9.48	0.30	8.00	0.40	8.26
	0700	0.24	9.85	0.32	9.48	0.30	10.24	0.37	7.11
	1300	0.47	6.74	0.51	7.31	0.47	6.24	0.64	7.53
18	0100	0.51	7.76	0.65	3.20	0.50	8.00	0.76	7.53
	0700	0.46	8.00	0.62	7.76	0.48	7.76	0.73	7.31
	1300	0.44	8.00	0.63	7.76	0.48	7.53	0.69	8.00
19	0100	0.47	7.11	0.64	7.31	0.53	3.46	0.75	6.92
	0700	0.51	9.48	0.73	4.13	0.62	9.85	0.80	3.82
	1300	0.61	9.48	0.81	9.14	0.71	8.83	0.82	8.83
20	0100	0.62	9.14	0.87	9.14	0.73	8.83	0.86	8.83
	1900	0.56	8.53	0.80	8.53	0.69	8.83	0.86	9.14

* Electronic problems

(Continued)

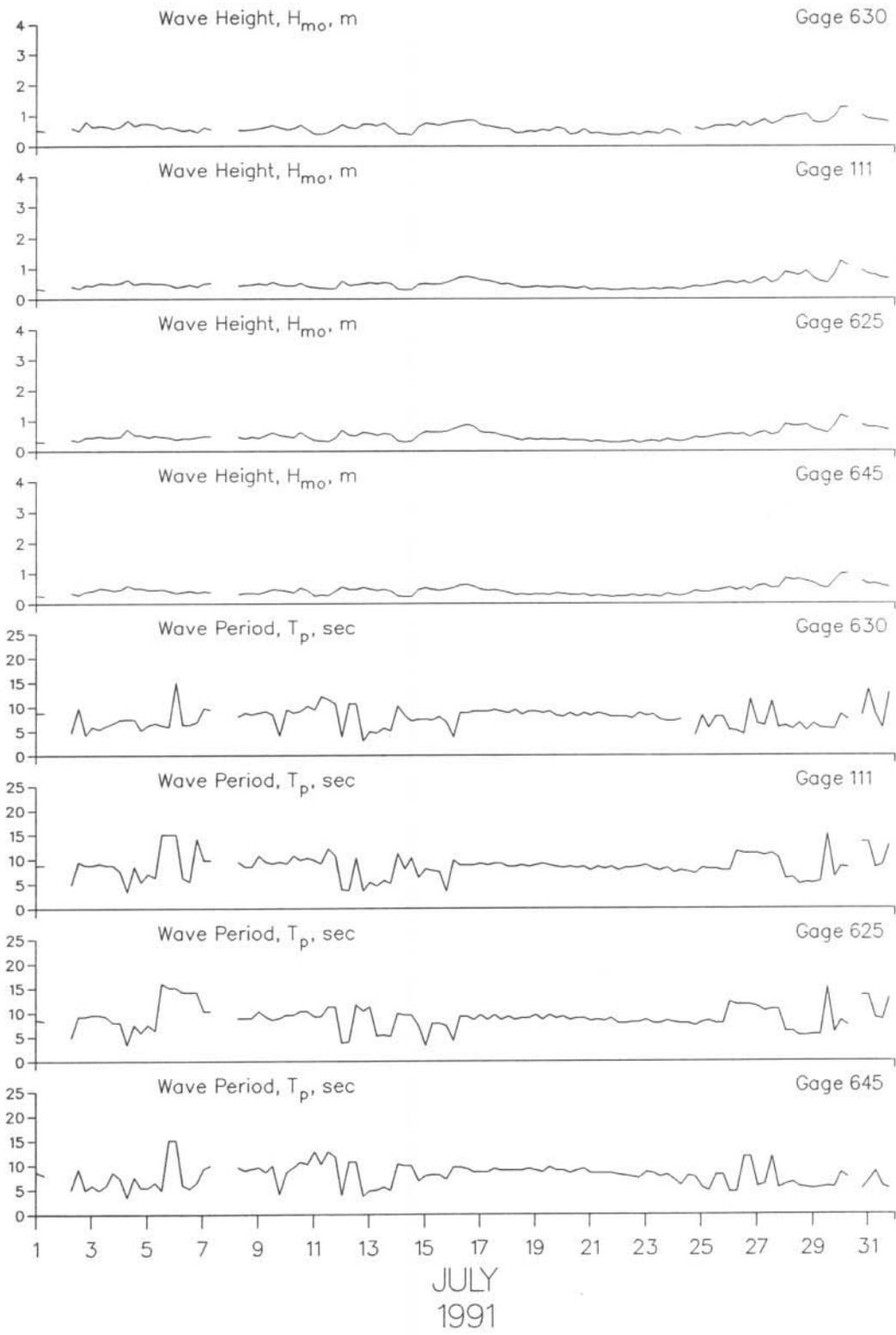
Table 3: Wave Data

Jul 1991

Day	Hour	645		625		111		630	
		Baylor Hmo.m	at 7+80 T.sec	Baylor Hmo.m	at 18+60 T.sec	Pressure Hmo.m	Gage T.sec	Offsh Hmo.m	Wvrdr T.sec
17	0100	0.47	8.53	0.63	9.48	0.63	9.14	0.71	9.14
	0700	0.43	8.53	0.60	8.53	0.61	8.83	0.67	9.14
	1300	0.44	9.14	0.58	9.48	0.56	9.14	0.64	9.48
	1900	0.42	8.83	0.51	8.53	0.48	9.14	0.59	9.14
18	0100	0.37	8.83	0.48	9.14	0.50	8.53	0.58	8.83
	0700	0.29	8.83	0.40	8.53	0.43	8.53	0.45	9.48
	1300	0.30	8.83	0.36	8.83	0.37	8.83	0.44	8.53
	1900	0.28	9.14	0.41	8.83	0.38	8.53	0.50	9.14
19	0100	0.31	8.83	0.38	9.48	0.40	8.83	0.47	9.14
	0700	0.31	8.53	0.39	8.53	0.39	9.14	0.54	8.83
	1300	0.29	9.48	0.38	9.48	0.37	8.83	0.49	9.14
	1900	0.34	8.83	0.38	8.83	0.40	8.53	0.61	8.26
20	0100	0.32	8.83	0.40	9.14	0.39	8.26	0.57	8.00
	0700	0.29	8.26	0.35	8.53	0.36	8.53	0.39	8.83
	1300	0.28	8.83	0.35	8.83	0.34	8.26	0.42	8.00
	1900	0.31	9.14	0.35	8.83	0.38	8.53	0.57	8.83
21	0100	0.24	8.26	0.31	8.26	0.31	7.76	0.43	8.26
	0700	0.27	8.26	0.34	8.53	0.31	8.53	0.44	8.83
	1300	0.26	8.26	0.30	8.26	0.32	8.00	0.40	8.53
	1900	0.22	8.26	0.28	8.83	0.29	8.53	0.38	8.00
22	0100	0.24	8.00	0.29	7.76	0.29	7.76	0.38	8.00
	0700	0.24	7.76	0.31	7.76	0.29	8.26	0.38	8.00
	1300	0.29	7.53	0.34	8.00	0.33	8.26	0.43	7.76
	1900	0.24	7.31	0.27	8.00	0.30	8.53	0.37	8.83
23	0100	0.27	8.53	0.33	8.53	0.29	8.83	0.46	8.26
	0700	0.25	8.26	0.33	7.76	0.33	8.00	0.43	8.53
	1300	0.23	7.53	0.30	7.76	0.29	7.76	0.40	7.53
	1900	0.32	8.00	0.39	8.26	0.34	8.26	0.54	7.11
24	0100	0.28	6.92	0.34	8.00	0.33	7.31	0.50	7.11
	0700	0.26	5.82	0.32	7.76	0.30	7.76	0.38	7.53
	1300	0.30	7.76	0.36	7.76	0.35	7.53	*	
	1900	0.41	7.53	0.44	7.31	0.41	7.11	0.61	4.13
25	0100	0.37	5.45	0.43	8.00	0.40	8.26	0.54	8.26
	0700	0.37	4.74	0.45	8.26	0.43	8.00	0.59	5.69
	1300	0.43	8.00	0.50	7.76	0.47	8.00	0.67	8.00
	1900	0.47	8.00	0.54	7.76	0.53	7.76	0.67	8.00
26	0100	0.51	4.57	0.55	12.19	0.55	7.76	0.69	5.22
	0700	0.43	4.49	0.53	11.64	0.50	11.64	0.63	5.12
	1300	0.53	11.64	0.56	11.64	0.57	11.13	0.79	4.41
	1900	0.41	11.64	0.45	11.64	0.47	11.13	0.65	11.64
27	0100	0.57	5.69	0.57	11.13	0.59	11.13	0.75	6.56
	0700	0.62	6.09	0.63	10.24	0.70	10.67	0.88	6.24
	1300	0.50	11.64	0.52	10.67	0.52	11.13	0.73	11.13
	1900	0.51	5.33	0.57	10.67	0.60	10.24	0.80	5.82
28	0100	0.82	5.95	0.88	6.09	0.87	6.09	0.95	6.09
	0700	0.78	6.40	0.82	6.09	0.82	6.24	0.96	5.45
	1300	0.79	5.57	0.83	5.22	0.77	4.92	1.01	6.74
	1900	0.74	5.33	0.86	5.22	0.91	5.22	1.04	5.12
29	0100	0.66	5.12	0.72	5.45	0.67	5.12	0.79	6.56
	0700	0.54	5.33	0.66	5.45	0.57	5.45	0.76	5.69
	1300	0.50	5.57	0.57	15.06	0.52	15.06	0.80	5.57
	1900	0.75	5.45	0.81	5.82	0.78	6.40	0.96	5.45
30	0100	0.96	8.26	1.16	8.26	1.23	8.53	1.27	8.53
	0700	0.98	7.31	1.06	7.31	1.08	8.26	1.25	7.31
	1300								
	1900	0.74	5.02	0.86	13.47	0.93	13.47	1.02	8.26
31	0100	0.63	6.56	0.76	13.47	0.80	13.47	0.89	13.47
	0700	0.64	8.53	0.77	8.83	0.77	8.26	0.88	8.53
	1300	0.57	5.69	0.73	8.53	0.67	8.83	0.84	5.69
	1900	0.53	5.12	0.67	12.80	0.65	12.80	0.79	12.80
	Mean	0.43	7.78	0.51	8.86	0.49	8.60	0.63	7.79
	Std dev	0.15	2.27	0.17	2.47	0.17	2.38	0.18	2.09

* Electronic problems

(Sheet 2 of 2)



PART IV: CURRENT DATA

Current data (Table 4) are collected from a Marsh-McBirney electromagnetic biaxial current meter (Table 1 and Figure 2) and by visually observing the movement of dye on the water surface in the surf and at the seaward end of the pier, as well as 500 m updrift of the pier 12 m offshore.

Since the shoreline orientation is approximately N20W, longshore currents flow either toward 340 deg (i.e. northward) or toward 160 deg (i.e. southward). Similarly, cross-shore currents are either onshore (westward) or offshore (eastward).

All current speeds are given in centimeters per second (cm/sec). Resultant speeds and directions are determined by vector averaging the data.

Table 4: Current Data
Jul 1991

Day	Time	Pier Measurements					Beach Measurements			Current Meter	
		Dye at (579 m) (surface)		Dye at Mid-Surf Zone (surface)		(500m Updrift)			0.9 km Offshore		
		Speed	Dir	Distance from Baseline (m)	Speed	Dir	Location	Speed	Dir	Depth -5.6m (NGVD) ID #519	
1	0100	Along								1	N
		Cross								3	on
		Result								3	268
1	0700	Along	8	S		9	S			3	S
		Cross	16	off	177	9	off	South	4	4	on
		Result	18	97		12	115			5	213
1	1300	Along									
		Cross									
		Result									
1	1900	Along									
		Cross									
		Result									
2	0100	Along									
		Cross									
		Result									
2	0700	Along	7	N		0			9	2	N
		Cross	6	off	165	3	off	South		4	on
		Result	9	22		3	70			4	277
2	1300	Along								8	S
		Cross								4	off
		Result								9	133
2	1900	Along								8	N
		Cross								5	on
		Result								9	308
3	0100	Along								4	N
		Cross								5	on
		Result								6	289
3	0700	Along	11	N		3	N		12	4	N
		Cross	23	on	165	0		South		3	off
		Result	25	277		3	340			5	17
3	1300	Along								5	N
		Cross								0	
		Result								5	340
3	1900	Along								6	N
		Cross								5	on
		Result								8	300
4	0100	Along								1	N
		Cross								3	on
		Result								3	268
4	0700	Along	34	N		16	N		16	20	N
		Cross	14	on	177	0		South		6	off
		Result	36	318		16	340			21	357
4	1300	Along								13	S
		Cross								9	on
		Result								16	195
4	1900	Along								4	S
		Cross								1	on
		Result								4	174
5	0100	Along								1	N
		Cross								0	
		Result								1	340
5	0700	Along	0			0			3	3	S
		Cross	0		152	10	off	South		2	off
		Result	0	0		10	70			4	126
5	1300	Along								11	S
		Cross								9	off
		Result								14	121
5	1900	Along								9	S
		Cross								9	off
		Result								13	115

KEY = All speeds in cm/sec
 N = Northward, Shore parallel
 S = Southward, Shore parallel
 on = onshore off = offshore

Table 4: Current Data (Continued)
Jul 1991

Day	Time	Pier Measurements					Beach Measurements			Current Meter	
		Dye at (579 m) (surface)		Dye at Mid-Surf Zone (surface)	Dye 12m offshore (surface)		Dye 12m offshore (surface)		0.9 km Offshore Depth -5.6m (NGVD) ID #519		
		Speed	Dir	Distance from Baseline (m)	Speed	Dir	Location	Speed	Dir	Speed	Dir
6	0100									9	S
										1	off
										9	154
6	0700	41	S		30	S		14	S	15	S
		10	on	165	9	on	South			8	off
		42	174		32	177				17	132
6	1300									16	S
										14	off
										21	119
6	1900									7	S
										0	
										7	160
7	0100									3	S
										3	on
										4	205
7	0700	18	S		25	S		14	S	8	S
		4	off	177	4	off	North			7	off
		18	146		26	151				11	119
7	1300										
7	1900										
8	0100										
8	0700	5	N		0			1	N	4	N
		3	off	177	0		South			6	on
		6	7		0	0				7	284
8	1300									17	N
										9	off
										19	8
8	1900									0	
										2	off
										2	70
9	0100									6	N
										8	on
										10	287
9	0700	47	S		41	S		1	S	1	N
		0		177	0		North			3	off
		47	160		41	160				3	52
9	1300									1	S
										18	off
										18	73
9	1900									6	S
										1	off
										6	151
10	0100									1	N
										2	on
										2	277
10	0700	13	S		19	S		17	N	10	S
		3	on	177	3	on	North			4	off
		14	174		19	169				11	138
10	1300									2	S
										5	off
										5	92
10	1900									11	N
										1	off
										11	345

KEY = All speeds in cm/sec
 N = Northward, Shore parallel
 S = Southward, Shore parallel
 on = onshore off = offshore

Table 4: Current Data (Continued)
Jul 1991

Day	Time	Pier Measurements					Beach Measurements			Current Meter	
		Dye at (579 m) (surface)		Dye at Mid-Surf Zone (surface)	Dye 12m offshore (surface)		(500m Updrift)		0.9 km Offshore		
	Result	Speed	Dir	Distance from Baseline (m)	Speed	Dir	Location	Speed	Dir	Depth -5.6m (NGVD) ID #519	Dir
11	0100	Along								9	N
		Cross								4	on
		Result								10	316
11	0700	Along	41	S		13	S	5	S	1	N
		Cross	0		177	4	on	North		4	off
		Result	41	160		14	177			4	56
11	1300	Along								3	S
		Cross								8	off
		Result								9	91
11	1900	Along								10	N
		Cross								7	on
		Result								12	305
12	0100	Along								4	N
		Cross								0	
		Result								4	340
12	0700	Along	8	S		9	S	8	S	2	N
		Cross	4	on	165	3	on	North		1	on
		Result	9	187		9	179			2	313
12	1300	Along								0	
		Cross								0	
		Result								0	
12	1900	Along								16	N
		Cross								9	on
		Result								18	311
13	0100	Along								21	N
		Cross								6	on
		Result								22	324
13	0700	Along	38	N		22	N	18	N	2	N
		Cross	11	off	177	8	off	South		2	on
		Result	40	357		23	359			3	295
13	1300	Along								1	S
		Cross								2	on
		Result								2	223
13	1900	Along								5	N
		Cross								3	on
		Result								6	309
14	0100	Along								6	N
		Cross								6	off
		Result								8	25
14	0700	Along	3	N		0		5	N	5	N
		Cross	5	off	140	8	off	South		2	on
		Result	6	36		8	70			5	318
14	1300	Along								11	S
		Cross								8	off
		Result								14	124
14	1900	Along								10	N
		Cross								10	off
		Result								14	25
15	0100	Along								4	S
		Cross								4	off
		Result								6	115
15	0700	Along	41	S		20	S	6	N	27	S
		Cross	10	on	165	0		North		17	off
		Result	42	174		20	160			32	128
15	1300	Along								30	S
		Cross								13	off
		Result								33	137
15	1900	Along								25	S
		Cross								6	off
		Result								26	147

KEY = All speeds in cm/sec
 N = Northward, Shore parallel
 S = Southward, Shore parallel
 on = onshore off = offshore

Table 4: Current Data (Continued)
Jul 1991

Day	Time	Alongshore Cross-shore Resultant	Pier Measurements				Beach Measurements (500m Updrift)			Current Meter 0.9 km Offshore Depth -5.6m (NGVD) ID #519		
			Dye at (579 m) (surface) Speed	Dir	Dye at Mid-Surf Zone (surface) Distance from Baseline (m)	Speed	Dir	Location	Speed	Dir	Speed	Dir
16	0100	-Along Cross Result									14 11 18	S off 122
16	0700	-Along Cross Result	10 2 10	S on 169	177	30 8 31	N off 354	South	4	N	5 1 5	S off 149
16	1300	-Along Cross Result									16 16 23	S off 115
16	1900	-Along Cross Result									3 1 3	N on 322
17	0100	-Along Cross Result									3 2 4	N off 14
17	0700	-Along Cross Result	14 5 15	N on 318	177	12 0 12	N off 340	South	6	N	2 2 3	N off 25
17	1300	-Along Cross Result									0 2 2	off 70
17	1900	-Along Cross Result									11 4 12	N on 320
18	0100	-Along Cross Result									15 6 16	N on 318
18	0700	-Along Cross Result	44 7 44	N off 349	177	12 4 12	N off 357	South	14	N	22 5 23	N on 327
18	1300	-Along Cross Result									13 11 17	N off 20
18	1900	-Along Cross Result									7 6 9	N on 299
19	0100	-Along Cross Result									9 3 9	N on 322
19	0700	-Along Cross Result	38 4 38	N off 346	177	30 30 43	N off 25	South	19	N	8 2 8	N off 354
19	1300	-Along Cross Result									2 0 2	N 340
19	1900	-Along Cross Result									2 3 4	N on 284
20	0100	-Along Cross Result									5 5 7	N on 295
20	0700	-Along Cross Result	8 6 10	N off 17	177	13 7 15	N off 7	South	16	N	1 1 1	N on 295
20	1300	-Along Cross Result									5 0 5	N 340
20	1900	-Along Cross Result									14 4 15	N off 356

KEY = All speeds in cm/sec
N = Northward, Shore parallel
S = Southward, Shore parallel
on = onshore off = offshore

Table 4: Current Data (Continued)
Jul 1991

Day	Time	Pier Measurements					Beach Measurements			Current Meter	
		Dye at (579 m) (surface)		Dye at Mid-Surf Zone (surface)		(500m Updrift)			0.9 km Offshore		
Resultant	Speed	Dir	Distance from Baseline (m)	Speed	Dir	Location	Speed	Dir	Depth -5.6m (NGVD)	ID #519	
21	0100	Along									
		Cross									
		Result									
21	0700	Along	11	N							
		Cross	11	off	165	7	N	10	N		
		Result	15	25		5	off	2	off		
21	1300	Along									
		Cross									
		Result									
21	1900	Along									
		Cross									
		Result									
22	0100	Along									
		Cross									
		Result									
22	0700	Along	0								
		Cross	6	off	177	0		9	N		
		Result	6	70		10	off	3	S		
22	1300	Along									
		Cross									
		Result									
22	1900	Along									
		Cross									
		Result									
23	0100	Along									
		Cross									
		Result									
23	0700	Along	0								
		Cross	3	off	177	0		2	N		
		Result	3	70		6	off	6	off		
23	1300	Along									
		Cross									
		Result									
23	1900	Along									
		Cross									
		Result									
24	0100	Along									
		Cross									
		Result									
24	0700	Along	10	S							
		Cross	10	off	177	0		2	N		
		Result	14	115		8	off	4	S		
24	1300	Along									
		Cross									
		Result									
24	1900	Along									
		Cross									
		Result									
25	0100	Along									
		Cross									
		Result									
25	0700	Along	0								
		Cross	5	off	165	9	N	13	N		
		Result	5	70		5	off	3	off		
25	1300	Along									
		Cross									
		Result									
25	1900	Along									
		Cross									
		Result									

KEY = All speeds in cm/sec
 N = Northward, Shore parallel
 S = Southward, Shore parallel
 on = onshore off = offshore

Table 4: Current Data (Continued)
Jul 1991

Day	Time	Alongshore Cross-shore Resultant	Pier Measurements				Beach Measurements (500m Updrift)			Current Meter 0.9 km Offshore Depth -5.6m (NGVD) ID #519		
			Dye at (579 m) (surface) Speed	Dir	Dye at Mid-Surf Zone (surface) Distance from Baseline (m)	Speed	Dir	Location	Speed	Dir	Speed	Dir
26	0100	-Along Cross Result									2 1 2	N off 7
26	0700	-Along Cross Result	10 3 10	N off 357	152	11 6 12	N off 7	South	13	N	2 10 10	N off 59
26	1300	-Along Cross Result									2 2 3	N on 295
26	1900	-Along Cross Result									8 0 8	N 340
27	0100	-Along Cross Result									2 0 2	N 340
27	0700	-Along Cross Result	44 4 44	N on 334	177	23 0 23	N off 340	South	18	N	6 20 21	N off 53
27	1300	-Along Cross Result									3 2 4	N on 306
27	1900	-Along Cross Result									6 7 9	S off 111
28	0100	-Along Cross Result									10 10 14	S off 115
28	0700	-Along Cross Result	36 4 36	S on 166	165	11 3 12	S off 143	no observation			16 12 20	S off 123
28	1300	-Along Cross Result									22 12 25	S off 131
28	1900	-Along Cross Result									41 17 44	S off 137
29	0100	-Along Cross Result									26 16 31	S off 128
29	0700	-Along Cross Result	0 17 17	off 70	152	5 8 9	N off 40	South	8	N	23 7 24	S off 143
29	1300	-Along Cross Result									15 4 16	S off 145
29	1900	-Along Cross Result									18 13 22	S off 124
30	0100	-Along Cross Result									43 17 46	S off 138
30	0700	-Along Cross Result	12 4 12	N off 359	165	29 15 32	S off 133	North	15	N	12 0 12	S 160
30	1300	-Along Cross Result										
30	1900	-Along Cross Result									9 3 9	S off 142

KEY = All speeds in cm/sec
 N = Northward, Shore parallel
 S = Southward, Shore parallel
 on = onshore off = offshore

Table 4: Current Data (Concluded)
Jul 1991

Day	Time	Alongshore Cross-shore Resultant	Pier Measurements				Beach Measurements (500m Updrift)			Current Meter 0.9 km Offshore Depth -5.6m (NGVD) ID #519		
			Dye at (579 m) (surface)		Dye at Mid-Surf Zone (surface) Distance from Baseline (m)		Dye 12m offshore (surface)			Speed	Dir	
			Speed	Dir	Speed	Dir	Location	Speed	Dir	Speed	Dir	
31	0100	-Along Cross Result								19	S	
										5	off	
										20	145	
31	0700	-Along Cross Result	16 2 17	S on 169	165	3 0 3	N 340	South	14	N	12 9 15	S off 123
31	1300	-Along Cross Result								14 10 17	S off 124	
31	1900	-Along Cross Result								5 6 8	S off 110	

KEY = All speeds in cm/sec
 N = Northward, Shore parallel
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 on = onshore off = offshore

PART V: SUPPLEMENTAL OBSERVATIONS

Visual wave direction measurements (Table 5) of both the primary wave train (i.e. that having the larger wave heights) and the secondary wave train (which must be clearly distinguishable as a wave train separate from the primary waves but not surface chop or capillary waves) are taken daily at the seaward end of the pier. The direction of the primary wave train just north of the seaward end of the pier is also determined using a Raytheon Marine Pathfinder radar and measuring the alignment of the wave crests at approximately the same location as the visual measurements. The pier axis (considered perpendicular to the beach at the FRF) is orientated 70 deg east of true north; consequently, wave angles greater than 70 deg indicate that the waves were coming from the south side of the pier.

The width of the surf zone (seawardmost breaker position to shoreline) is determined from the pier deck.

Measurements of surface water temperature, density, and visibility are also taken daily at the seaward end of the pier. A jar along with a thermometer is lowered about 0.3 m into the water and allowed to remain for at least one minute. The jar is removed, the temperature read, and a hydrometer is used to determine the density. A Secchi disc is used to determine the surface visibility.

Table 5: Supplemental Observations

Jul 1991

Day	Time	Wave Approach Angle at Pier End deg from True N		Radar Wave Angle deg from True N	Width of Surf Zone,m	Water Characteristics at Pier End		
		Primary	Secondary			Temp.,C	Density g/cc	Secchi Vis.,m
1	0756	100			5	21.1	1.0222	2.4
2	0714	110			6	23.3	1.0219	4.3
3	0811	115			8	25.0	1.0208	5.2
4	0641	75		100	12	24.4	1.0211	5.2
5	0800	110	20		46	23.3	1.0214	5.5
6	1030	110	45		4	26.1	1.0200	5.5
7	0752	100			11	26.7	1.0203	4.3
8	0850	100			11	26.1	1.0202	5.2
9	0735	35		60	10	25.6	1.0206	5.5
10	0800	60		80	8	27.2	1.0207	4.3
11	0800	95			2	27.2	1.0200	6.1
12	0815	95		80	5	27.8	1.0198	5.5
13	1100	110			9	24.4	1.0210	2.4
14	0940	110			12	22.2	1.0218	3.4
15	0815	95	40	50	5	26.1	1.0200	3.4
16	0800	85		85	15	26.7	1.0193	4.3
17	0830	90			15	26.7	1.0186	5.5
18	0830	110			8	26.7	1.0202	4.3
19	0815	110			8	21.1	1.0224	2.4
20	0730	130			9	18.3	1.0234	3.4
21	0922	120			6	18.9	1.0232	4.6
22	0822	120			6	19.4	1.0230	5.5
23	0750	130			3	18.9	1.0236	5.2
24	0739	140			5	20.0	1.0230	6.7
25	0815	120			4	21.1	1.0229	7.6
26	0745	115			14	20.6	1.0228	7.0
27	0844	100			15	23.3	1.0220	8.5
28	0857	25	120		15	21.1	1.0220	3.7
29	0810	120	30		12	25.6	1.0197	3.7
30	0810	30	115		87	25.6	1.0187	3.7
31	0809	100			81	25.0	1.0208	3.0

PART VI: WATER LEVELS

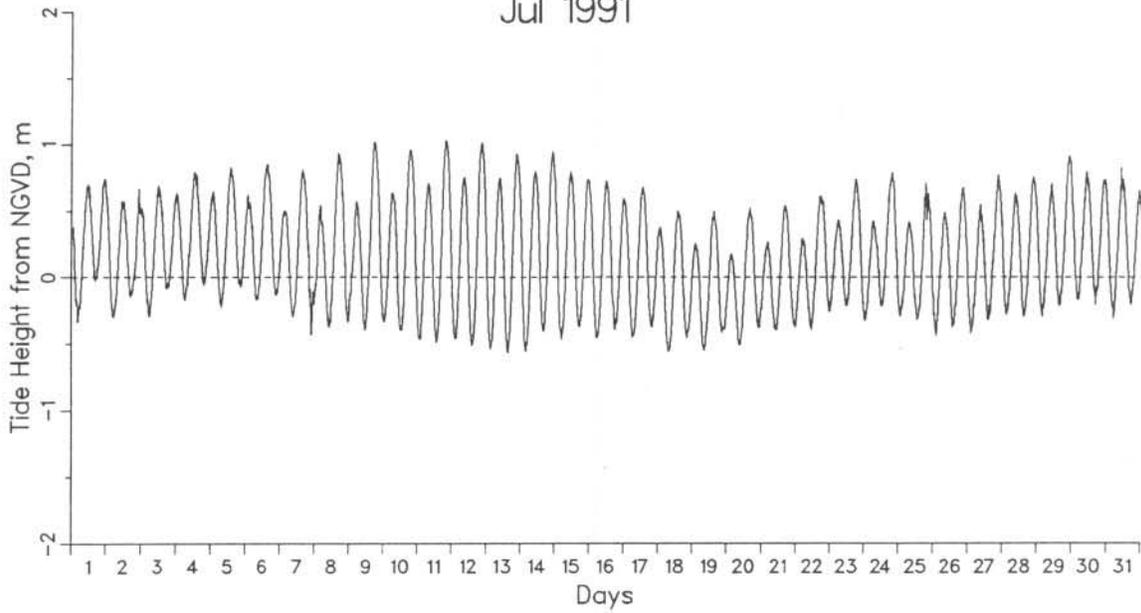
Since 1978, the National Oceanic and Atmospheric Administration (NOAA)/National Ocean Service (NOS) has operated a primary tide station (No. 865-1370) at the seaward end of the FRF pier. A Leupold-Stevens digital recording float-type tide gage is used to collect instantaneous water level data every 6 minutes throughout the month.

The variation in water level during the month is shown in Figure 4 along with a list of mean and extreme values. This presentation is useful in identifying effects of both meteorological and astronomical forces on the open coast water level.

Table 6 contains the time at the center of each 12.42-hr tidal cycle and the range, high, low, and mean water levels during each tidal cycle.

FRF Tide Heights

Jul 1991



Monthly Water Levels, m NGVD

Extreme Low = -0.56 on day 13 at 1430 EST
Extreme High = 1.03 on day 11 at 1830 EST
Monthly Mean = 0.17
Mean Low = -0.34
Mean High = 0.70
Mean Range = 1.03

Table 6: Water Levels.m NGVD

		Jul 1991			
Mid-Cycle	Low	High	Mean	Range	
Day	Time				
1	612	-0.34	0.70	0.21	1.04
1	1837	-0.02	0.74	0.35	0.77
2	702	-0.30	0.57	0.14	0.87
2	1927	-0.15	0.67	0.22	0.81
3	752	-0.30	0.69	0.20	0.99
3	2018	-0.08	0.63	0.26	0.72
4	843	-0.17	0.79	0.31	0.96
4	2108	-0.06	0.65	0.30	0.70
5	933	-0.22	0.83	0.30	1.05
5	2158	-0.07	0.62	0.27	0.69
6	1024	-0.17	0.85	0.33	1.02
6	2249	-0.14	0.53	0.21	0.67
7	1114	-0.30	0.81	0.24	1.11
7	2339	-0.43	0.54	0.12	0.97
8	1204	-0.37	0.93	0.25	1.30
9	30	-0.34	0.59	0.16	0.93
9	1255	-0.40	1.02	0.29	1.41
10	120	-0.34	0.68	0.19	1.02
10	1345	-0.40	0.96	0.25	1.36
11	210	-0.46	0.71	0.16	1.17
11	1436	-0.49	1.03	0.25	1.52
12	301	-0.46	0.76	0.18	1.22
12	1526	-0.51	1.01	0.23	1.52
13	351	-0.54	0.76	0.13	1.30
13	1616	-0.56	0.93	0.18	1.49
14	442	-0.55	0.80	0.14	1.35
14	1707	-0.41	0.94	0.26	1.35
15	532	-0.47	0.80	0.18	1.26
15	1757	-0.37	0.74	0.20	1.11
16	622	-0.46	0.72	0.12	1.18
16	1847	-0.39	0.59	0.13	0.98
17	713	-0.45	0.67	0.09	1.12
17	1938	-0.37	0.52	0.05	0.90
18	803	-0.56	0.50	-0.06	1.05
18	2028	-0.45	0.40	-0.05	0.86
19	853	-0.55	0.50	-0.07	1.05
19	2119	-0.42	0.37	-0.08	0.79
20	944	-0.51	0.52	-0.05	1.03
20	2209	-0.38	0.45	-0.01	0.83
21	1034	-0.40	0.54	0.02	0.94
21	2259	-0.37	0.46	0.01	0.84
22	1125	-0.39	0.61	0.08	1.00
22	2350	-0.26	0.58	0.14	0.83
23	1215	-0.21	0.74	0.21	0.95
24	40	-0.32	0.61	0.10	0.94
24	1305	-0.22	0.78	0.24	1.00
25	131	-0.29	0.71	0.12	1.00
25	1356	-0.32	0.71	0.13	1.03
26	221	-0.44	0.52	0.08	0.96
26	1446	-0.37	0.68	0.14	1.05
27	311	-0.42	0.55	0.07	0.97
27	1537	-0.32	0.77	0.19	1.09
28	402	-0.28	0.63	0.19	0.91
28	1627	-0.30	0.76	0.22	1.05
29	452	-0.29	0.71	0.21	1.00
29	1717	-0.21	0.91	0.33	1.12
30	543	-0.17	0.79	0.31	0.96
30	1808	-0.20	0.73	0.30	0.94
31	633	-0.31	0.83	0.25	1.14
31	1858	-0.20	0.66	0.21	0.86

PART VII: NEARSHORE PROFILES

A. Nearshore Profiles. In order to document profile response away from the pier, surveys of four profile lines extending 900 to 1,000 m from shore and located 489 and 581 m north and 517 and 608 m south of the FRF pier are conducted bi-weekly, after storms, and during more complete bathymetric surveys.

These profiles are obtained using the CRAB-Geodimeter surveying system; a Geodimeter 140-T self-tracking, electronic theodolite, distance meter, in combination with the Coastal Research Amphibious Buggy (CRAB), a 10.7 m high, self-powered, mobile tripod on wheels.

Figure 5 shows the last survey in June and the two surveys in July on profile line 188, located 517 m south of the pier. A 30 m shoreward migration of the nearshore bar (160 - 240 m) was the only significant change to the profile.

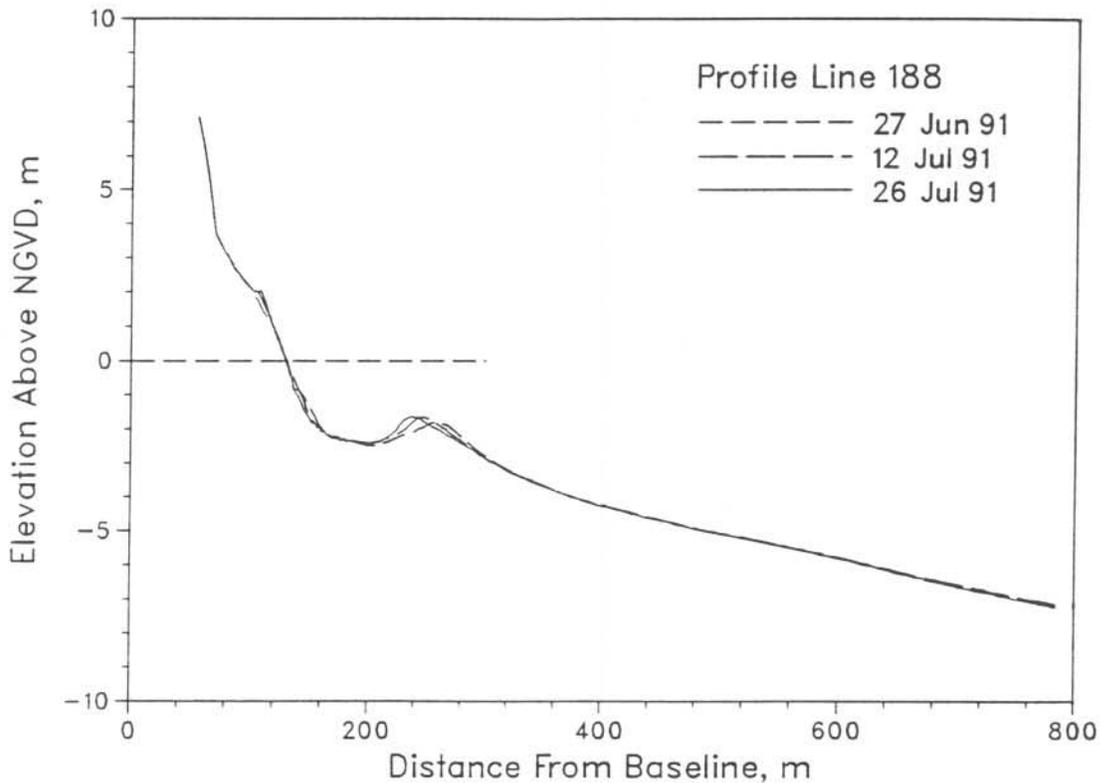


Figure 5. Monthly CRAB profiles on profile 188 - 517 m south of pier.

The profile envelope (Figure 6) reflects the maximum changes that occurred on the profile during 1991. The small change to the envelope (260 m) was caused by the movement of the nearshore bar.

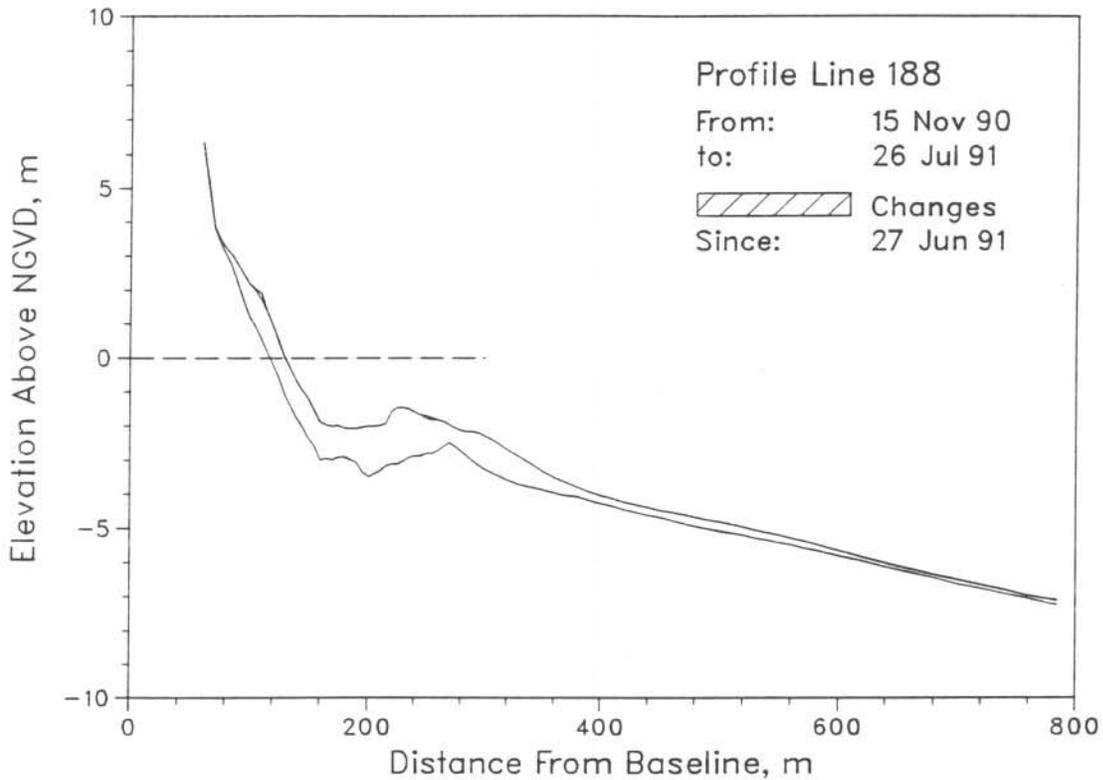


Figure 6. CRAB profile envelope - profile 188.

B. Bathymetry. Figure 7 includes a two- and three-dimensional contour map and a change plot derived from the bathymetric survey on 27 June. Wide contour lines on the change diagram represent eroded areas; thin lines indicate deposition.

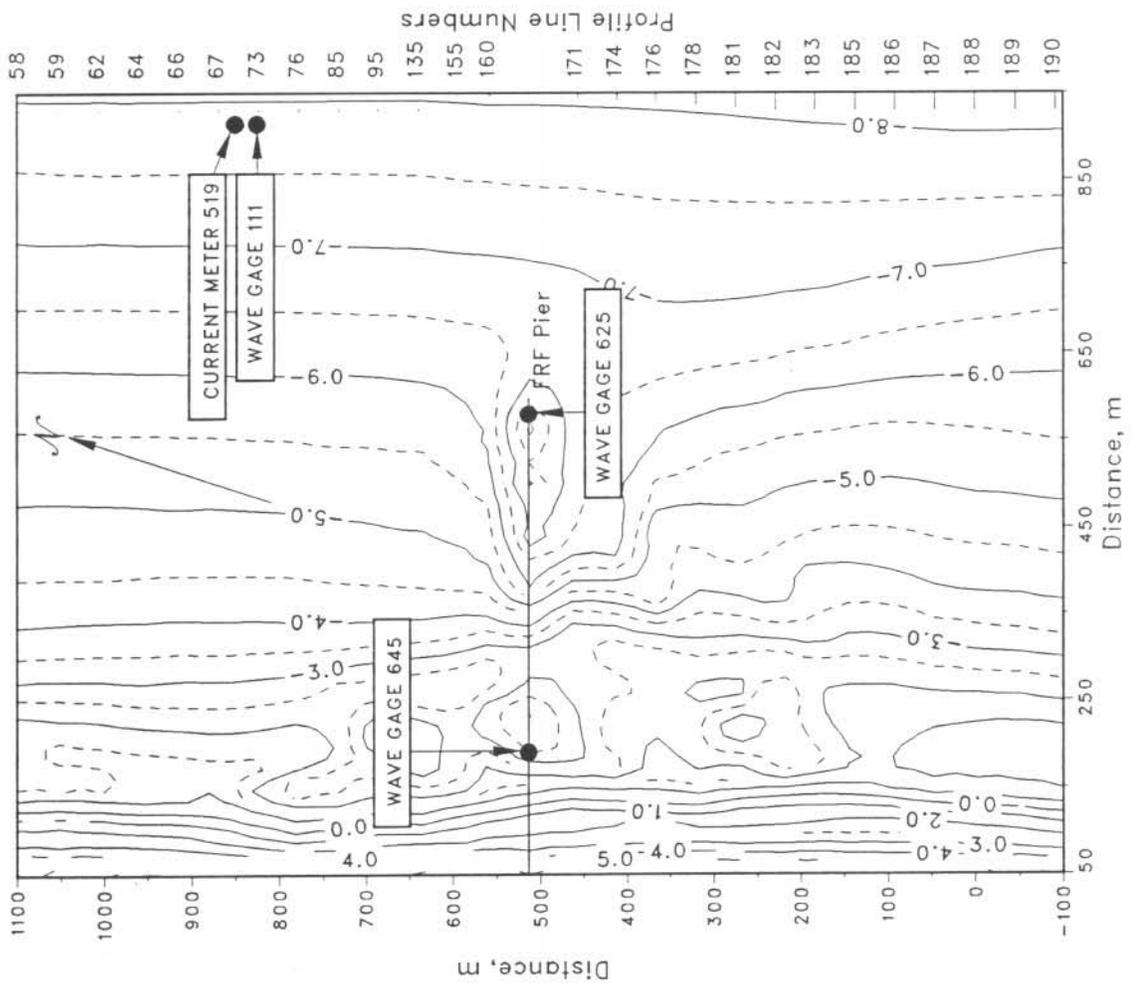
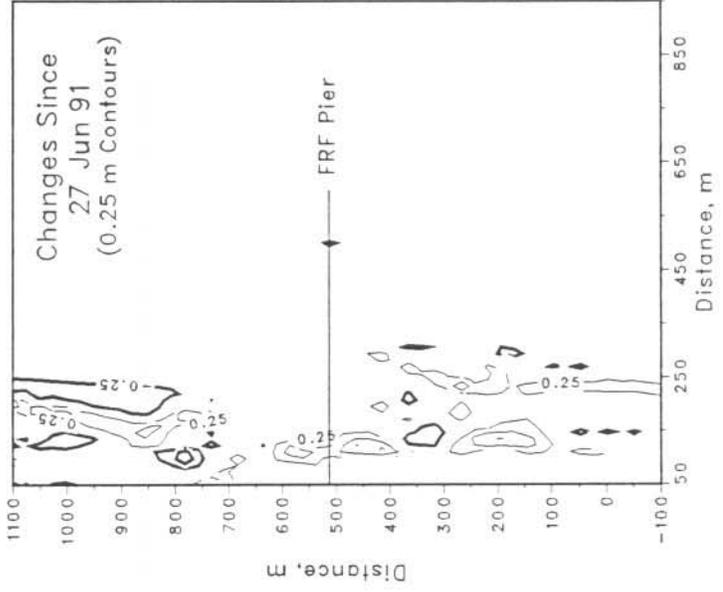
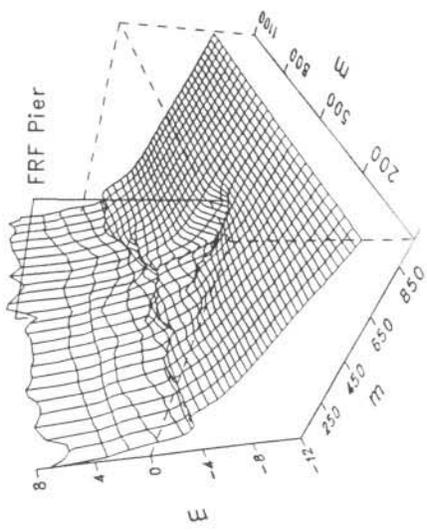


Figure 8. FRF bathymetry 26 Jul 91 depths relative to NGVD

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